PELVIC PRESSURE ULCER RECONSTRUCTIONS BY PEDICLED MUSCLE FLAPS

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ABSTRACT

INTRODUCTION: Pelvic region is the most predisposed topographic area of the body to pressure ulcers in immobile patients. This communication presents the experience of the authors and sets to discussion the value of the pedicled muscle flaps in the management of pressure ulcers stage III and IV.

MATERIAL AND METHODS: The study was conducted during the period from May 2006 to December 2014. A total of 11 muscle based flaps were applied on 5 male and one female patients with deep pressure ulcers in the pelvic region. Musculus gluteus maximus (MGM), musculus gracilis (MG), musculus hamstring (MH), musculus vastus lateralis femoris (MVLF) and musculus rectus abdominis (MRA) were designed as monocomponent muscle or compound skin-muscle flaps in accordance with the wound characteristics.

RESULTS: The patients were followed-up from 1 month to 6 years. All flaps were vital. Small area partial skin necrosis of the MRA flap and MH advancement flap required secondary surgical procedures within a month after the reconstruction. Four recurrences through variable periods were observed in one patient, operated on by different muscle flaps.

CONCLUSION: Pressure ulcers are a frequent complication in immobile patients. Surgery is the most effective treatment method for wounds at stages III and IV. Patient's general condition and wound status should be taken into consideration when planning the reconstruction. The vitality and volume of the muscle flaps are the main advantages of that alternative for surgical treatment of pelvic pressure sores.

Keywords: *pelvis, pressure ulcer, reconstruction, surgical flaps*

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INTRODUCTION

As type of trophic wounds, pressure ulcers have complex etiopathogenesis. They are localized mainly in the pelvic region over bony prominences of the sacral, ischial, and trochanteric areas. It is well established that these ulcers are caused by continuous pressure over tissues, which exceeds the capillary pressure (33 mmHg), resulted in ischemic necrosis (1). Other mechanical factors as shearing forces and friction can also provoke the initialization of

skin and underlying tissues injuries. Additional circumstances contributing to the evolution of pressure sores are moisture and poor ventilation causing maceration of the skin and development of local bacterial infection (1,2,3). Diabetes mellitus, malnutrition, hypoalbuminemia, alcoholism, smoking, fecal and urinary incontinence are also predisposing factors to pressure sore progression (4).

The planning of the surgical treatment of pressure ulcers is mainly based on the general condition of the patient and wound characteristics. The latter include localization, type of involved tissues, dimensions and microbiological status. Various classification systems have been published to assist the diagnostic process and faciltate electing the proper reconstructive method. We consider the proposed by the European Pressure Ulcer Advisory Panel in 2009 as the most relevant one (5). It classifies pressure ulcers according to the level of tissue destruction (Table 1). The lesions are divided into IV stages. Ulcers at stages I and II need a conservative, non-surgical approach, whereas stages III and IV normally require surgical management. The treatment of the superficial lesions includes all popular clinical procedures to prevent the ulcer progression, optimize and support local wound healing, and any other adjunctive medical cares of use. Deep lesions require two main surgical steps – debridement and reconstruction in order to prevent progressive osteomyelitis, reduce protein loss, improve quality of life, improve function and hygiene, and reduce rehabilitation and wound care costs (6).

By this article we aim to present our experience with surgical management of pressure ulcers by pedicled muscle flaps and set the topic to discussion.

MATERIAL AND METHODS

Between May 2006 and December 2014 we applied 11 pedicled muscle flaps on 6 patients (5 male and one female) aged from 28 to 72 (mean – 49.3 years) admitted for grade III and IV pelvic pressure ulcers. In the group, 5 patients suffered from inferior paraplegia and one from insultus cerebry. Pressure sores were localized in the ischial region in 7 cases or in the sacral region – in 4 cases. One of the patients underwent six surgeries and the rest 5 were operated on by a single reconstruction.

Five types of pedicled muscle based flaps were used in this study: MGM flap, MG flap, MVLF flap, MH skin-muscle advancement flap and MRA skin-muscle flap. MG flap was applied twice in one patient for both sides ischium pressure bursa. The same patient was treated also for recurrences in the left ischial region with inferior gluteal artery based MGM flap, MH V-Y advancement flap, repeat MH flap and MRA flap. One male patient was operated on for ischial bursa by MVLF flap. MGM turn over muscle flap, based on superior gluteal artery, was applied in combination with free skin graft to reconstruct sacral pressure sores in three patients. One split muscle V-Y MGM flap was utilized in combination with randomized local flap to cover large decubitus defect in the sacral region.

We start the operation with radical excision of all devitalized, fibrous and infected tissues. This involves resection of the underlying bone, if affected by osteomyelitis. Next, the muscle or skin-muscle flap is dissected regarding to the wound dimensions and specifics. The flap is transposed to the wound directly or through a tunnel. We draw special attention to remove dead space while fixing the flap by multiple quilting sutures. Leaving no space between the flap and the walls of the recipient defect, we do not use drainage. This step reduces the risk of seroma or haematoma collection. It should be done cautiously and precisely however, with the help of appropriate suture materials, since the blood circulation of the flap can be compromised. When treating bursa with small to moderate elliptical skin defect, we use muscle flap to fill the deep space of the wound and close the skin over the flap by means of interrupted sutures.

RESULTS

All flaps survived. Partial skin necrosis was observed in the patients treated by MH and MRA musculocutaneous flaps. The complications were cured by free skin grafting within the first postoperative month. Due to progressively developed heart failure in a patient suffering from insultus cerebry and diabetes mellitus, free skin graft lesion over MGM flap occurred. Four episodes of recurrences were documented in one patient. The relapse period varied from 6 to 18 months. The summarized data of the study including the applied types of flaps with respect to pressure wounds stage, localization, dimen-

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Table 1. European Pressure Ulcer Advisory Panel classification (2009)

Stage I	Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area.
Stage II	Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.
Stage III	Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.
Stage IV	Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling.

Fig. 1. MVLF flap application

***(A)** Pressure bursa in the left ischial region with wound area 7x3 cm and depth – 8 cm. **(B)** Left MVLF flap dissected. **(C)** The muscle transposed in the wound and fixed by multiple buried sutures. **(D)** Wound healing by primary intention.*

sions, as well as the events of early complications and recurrences are exposed in Table 2. Fig. 1 (A, B, C and D) demonstrated the MVLF flap application and Fig. 2 (A, B, C and D) - the split MGM V-Y flap application.

DISCUSSION

Presumably people have been suffering from pressure ulcers since the beginning of human existence. There are confirmed signs of decubitus in Egyptian mummies in 1961 by Rowling (7). In spite of the presence of the problem through the ages, nothing but insignificant contributions to the treatment have been described in scientific sources until the 20th century (8). Flap surgery was proposed to replace unstable scar of a healed pressure sore by Davis in 1938 (9). He is credited with being the first to perform surgical cure of pressure wounds. Based on the experience with 1 000 clinical cases, Conway and Griffith formulated the main principles of surgical treatment of pressure ulcers in 1956 (10). They accentuate on the importance of the radical debridement including scar tissues, underlying bursa and any other damaged structures. The underlying bone should be recontouring by ostectomy, to increase the surface area of the weight-bearing region. The area of pressure should be resurfaced with a large flap of healthy skin consisting either of muscle or subcutaneous fat with fascia. The suture line must be planned away from the area of direct pressure and designed so that it does not interfere with the design of other local flaps that may be needed if the wound recurs. These basic rules are still valid nowadays and have to be considered when planning a pressure ulcer reconstruction.

Many reconstructive techniques have been used for surgical management of bed-sores including direct closure, skin grafting, skin flaps, muscle and musculocutaneous flaps, perforator and free flaps.

Table 2. Summary of patients' data

№	Patient/Age/Sex	Year of surgery	Main disease	Pressure sore localization	Pressure sore grade	Wound area (cm)	Wound depth (cm)	Type of flap	Early Complications	Recurrence (until December 2014)
1	I.P./28/M	2006	Paraplegia inferior	Sacrum	III	8 x 6	2	Gluteus maximus	No	No
2	A.N./71/M	2007	Paraplegia inferior	Sacrum	IV	10 x 7	4	Gluteus maximus	No	No
3	A.Y./40/M	2008	Paraplegia inferior	Ischium Right	IV	7 x 3	12	Gracilis	No	No
4	A.Y./41/M	2009	Paraplegia inferior	Ischium Left	III	6 x 3	5	Gluteus maximus	No	6 months
5	A.Y./41/M	2009	Paraplegia inferior	Ischium Left	IV	5 x 2	5	Gracilis	No	8 months
6	P.D./72/M	2009	Insultus cerebri	Sacrum	IV	12 x 10	3	Gluteus maximus	Skin graft lesion	Exitus (1 month after surg.)
7	A.Y./42/M	2010	Paraplegia inferior	Ischium Left	IV	8 x 5	7	Hamstring	Partial skin necrosis	18 months
8	S.I./69/M	2012	Paraplegia inferior	Ischium Left	IV	7 x 3	8	Vastus lateralis	No	No
9	A.Y./44/M	2012	Paraplegia inferior	Ischium Left	IV	8 x 4	7	Repeat-Hamstring	No	11 months
10	A.Y./45/M	2013	Paraplegia inferior	Ischium left	IV	10 x 5	7	Rectus abdominis	Partial skin necrosis	No
11	M.A. /42/F	2014	Paraplegia inferior	Sacrum	IV	22x10	6	Gluteus maximus	No	No

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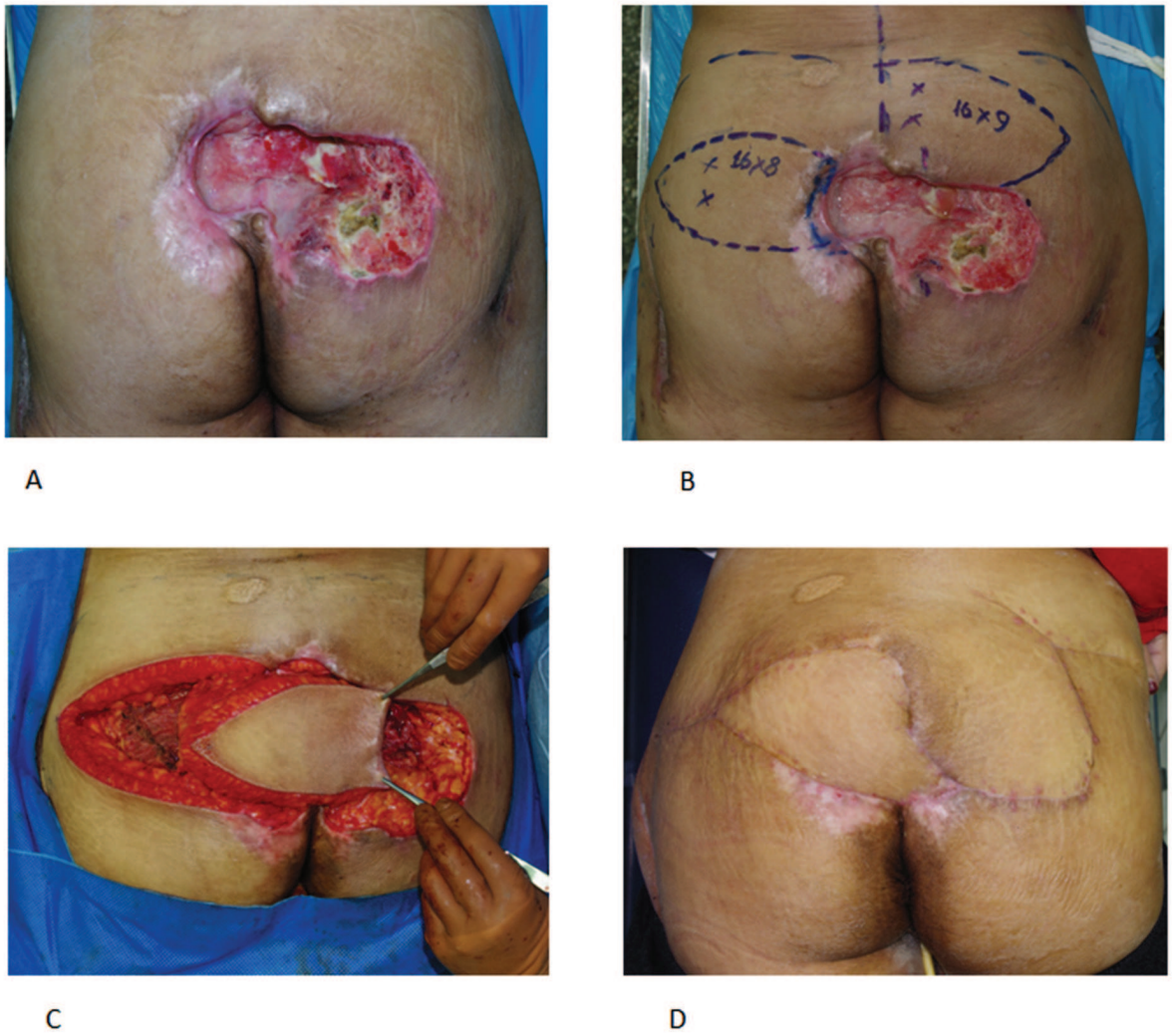

Fig. 2. Split MGM V-Y flap application

***(A)** Pressure ulcer defect in the scaral region after debridment with wound area 22x10 cm and depth – 6 cm. **(B)** Planning of left split MGM V-Y flap and additional randomized flap. **(C)** MGM V-Y flap disected and transposed over the midline of the sacrum. **(D)** Final result after two months.*

In this study we have counted on muscle and skin-muscle flaps. The advantages of muscle as plastic material are well established. It has the ability to substitute great volumes of damaged tissues and well-differentiated blood supply. The latter ensures higher local oxygen tension, improved antibiotic delivery, enhanced polymorphonuclear lymphocyte function and optimal healing conditions (11,12). Our decision to exploit muscle flaps was encouraged by previous experience with muscle tissue transfer for curing chronic wounds, deep burns, defects and deformities in other body regions.

MGM have been used as a rotational myocutaneous flap, split myocutaneous V-Y flap (13), split muscle-adipofascial turnover flap (14), bilateral V-Y advancement musculocutaneous flaps (15), etc. In patients 1, 2 and 6 we designed split muscle turnover flaps vascularized by superior gluteal vessels in addition to split thickness skin grafts to compensate tissue deficit over the sacrum. It was our belief that this approach is minimally traumatic, which is an important consideration in patients with accompanying disorders. Despite losing one of those patients owing to acute heart failure, we witnessed optimal recovery process and no recurrences in the rest. In patient 4 of

the series, a rotational muscle flap nourished by inferior gluteal vessels was utilized to fill the deep bursa over the ischial tuberosity. The flap healed by primary intention. Due to the persistent pressure influence over the underlying bone prominence however, the wound relapsed at the sixth month postoperatively.

In 1972 Pers and Medgyesi applied MG as a vascularized flap to reconstruct the cavity resulting from extirpation of the urinary bladder (16). A few years latter McCraw at al. report for successful vaginal reconstructions with gracilis myocutaneous flap (17). In 1980 Labandter published his results from the repair of perineal and ischial defects by means of MG and musculocutaneous flaps (18). Individually designed muscle, skin-muscle, inervated functional and micro-vascular free flaps, based on MG circulation are available today to meet the needs of reconstructive surgery in almost every part of human body. Our experience with MG flap is limited to cases 3 and 5. In fact, the two flaps were used consecutively in one patient. The right MG served to treat a deep bursa over ischium and no recurrence occurred till this moment (more than 6 years). Despite this success, the left ischial bursa reopened at the sixth postreconstructive month. Both surgeries had followed unified protocol and we could not define clear evidence to support the different outcomes.

The MH myocutaneous flap has been described by Hagerty et al. as a source of well-vascularized soft tissue mass to reconstruct the debrided ischial site. According to the author, further advantage of this flap is the feasibility to be done in one stage, without need of split grafting (19). Kroll and Hamilton advocate an extended MH V-Y myocutaneous advancement flap for its potential to cover unusually large defects in the ischial region (20). The flap can be reused to repair recurrent ischial pressure sores. Tavakoli et al. reported the use of the MH V-Y myocutaneous flap as a reliable and safe reconstructive modality for management of ischial pressure sores (21). We utilized MH V-Y myocutaneous advancement flap twice in one patient – cases 7 and 9. The primary flap resisted to the continuous postoperative pressure for 18 months, whereas the repeat flap – for 6 months only. What surprised us with this experience was the hip joint flexion contracture, due to the spastic character of the inferior paraplegy. Obviously, total sectioning of the posterior (Hamstring) musculature of the femur, should be avoided in patients suffering from spastic inferior paralisis.

MVLF is not among the frequently mentioned methods in the literature for ischial pressure ulcer reconstructions. Single reports are discovered for typical myocutaneous or tangentially split MVLF flaps for reconstructions of difficult and recurrent ischial pressure sores (22,23). Considering the pressure ulcer characteristics of case 8, as well as the proximity of the bursa opening to the hip joint, we decided to apply MVLF flap. The muscle was dissected and transferred to the wound throughout subcutaneous tunnel in addition to fascia lata sectioning. Since there was no skin deficit, after diligent fixation of the muscle body by multiple buried sutures to the wound walls, the skin was closed by simple interrupted sutures. Complications or recurrence were not observed.

Due to the long muscle body and dual dominant vascular supply, MRA flap offers one of the most versatile modalities for anterior chest, abdominal and pelvic reconstructions. The inferiorly based vertical MRA myocutaneous flap is advocated for both recalcitrant ischial and trochanteric pressure sores (24). The same flap has showed good and long term coverage of chronic perineal and ischial pressure sores in patients undergone other local and regional flap options (25). We used the inferiorly based vertical MRA myocutaneous flap in case 10. Four other flaps had already been used to treat the left ischium pressure sore in this patients with variable recurrence terms. Despite the small area of skin necrosis treated by free skin grafting within the first postoperative month, the flap healed well and no donor site complications were observed.

CONCLUSION

In this series of 11 clinical cases presented with stage III and IV pelvic pressure ulcers we used five types of muscle based flaps. The flaps were designed as monocomponent muscle unit or multicomponent skin-muscle complex in accordance with the particular need of the reconstruction. We applied most of the flaps once only, which is not sufficiently informative, regarding their relevance and effectiveness. Still, our experience confirms that all the methods have to be taken into consideration for the surgical treatment of pressure ulcers.

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